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I N S E C T S I N R E L A T I O N
T O
N A T I O N A L D E F E N S E

Circular 3

FABRIC INSECTS



February 1941
(Slightly Revised April 1942)

INSECTS IN RELATION

TO

NATIONAL DEFENSE

Circular 3 - Fabric Insects
(Revised)

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INTRODUCTION

All supplies used in connection with National Defense made of wool or mohair fibers, furs, or bristles must be protected from fabric pests. The chief items demanding such protection are woolen fabrics to be used in the manufacture of uniforms, woolen uniforms, blankets, wool and fur-lined helmets, boots and gloves,

sheepskin-lined harnesses and saddles, all sorts of animal fiber brushes, carpeting with wool pile fibers, upholstered furniture with animal-fiber covers, and in some instances the household possessions of various personnel stored in federal establishments.

INSECTS INVOLVED

The insect most commonly involved in the destruction of the above-mentioned supplies is the webbing clothes moth, although the case-making clothes moth and the tapestry moth may at times be destructive. Carpet beetles, or buffalo moths, are in some storages more destructive than clothes moths, but under most conditions are less so. In storages the furniture carpet beetle may become exceedingly destructive, with the common carpet beetle and the black carpet beetle playing roles of less importance.

EVIDENCES OF INFESTATION

Any experienced custodian of supplies susceptible to attack has no difficulty in detecting even slight injury by fabric pests. There are in evidence not only the holes eaten in the fabrics and furs, but an accumulation of sand-like pellets of excrement, dead insects, cast larval skins and in the case of the webbing clothes moth, the white silken tubes spun by the moth larvae over and through the affected materials.

DESCRIPTION OF FABRIC PESTS

Fabric pests are very small insects. The adult clothes moth is a buff or cream-colored miller with a wing spread of not more than one-half an inch. It flies or runs readily to concealment when disturbed. The

larva is white, seldom as long as one-half an inch when well grown, possesses a brownish head and usually encases itself in a silken tube into the outer walls of which it spins fragments of the material upon which it has been feeding, or pellets of excrement, in an effort to conceal itself. In Fig. 1 are shown the adults and larvae of the webbing clothes moth. In Fig. 2 is shown a piece of army suiting damaged by the webbing clothes moth larva.



Figure 1 - Adults and larvae of the webbing clothes moth, Tineola biselliella, shown with buttons 9/16 of an inch in diameter.

Carpet beetle adults are hard-shelled beetles about one-eighth of an inch long, seldom exceeding three-sixteenths of an inch in length. The adults of three species are shown in Figs. 3, 4 and 5. The larvae of the common carpet beetle and the furniture carpet beetle have the typical form shown in Fig. 6, while the larva of the black carpet beetle is more elongate in shape as indicated in Fig. 7 and of a golden or dark brown color.



Figure 2 - Piece of uniform fabric showing damage by the webbing clothes moth; note the long, cylindrical feeding tube that shelters the larva, the sand-like pellets of larval excrement in its shadow to the left, and at the lower right an area from which the nap has been eaten by the larva emerging from the feeding tube.

Carpet beetle larvae do not spin webs while feeding upon fabrics, furs, brushes, etc., and are apt to concentrate on certain portions of the article attacked. Bristle brushes may be completely ruined in short order if neglected.

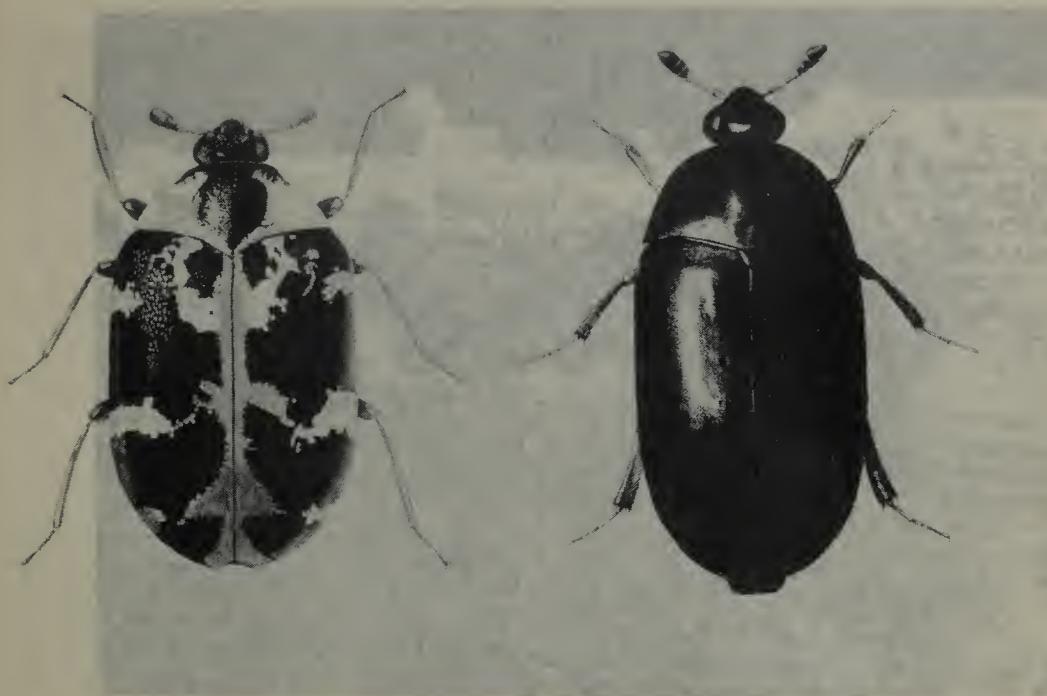


Figure 3 - Adult of the common carpet beetle, Anthrenus scrophulariae (much enlarged).

Figure 4 - Adult of the black carpet beetle, Attagenus piceus (much enlarged).



Figure 5 - Adult of the furniture carpet beetle, Anthrenus vorax (much enlarged).

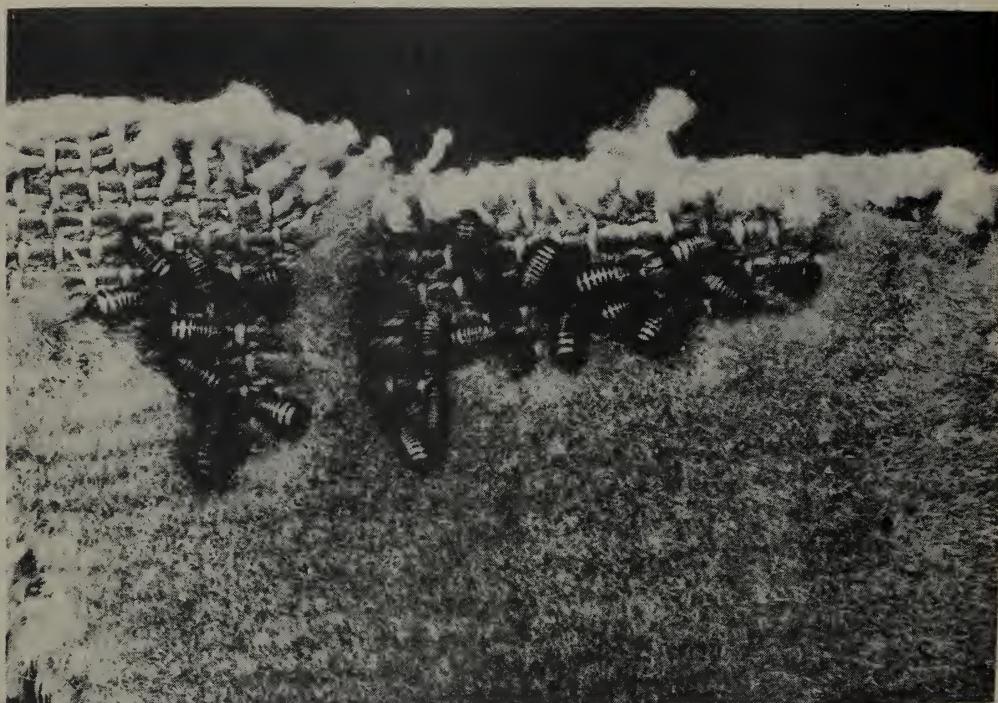


Figure 6 - A group of large Anthrenus carpet beetles feeding in a characteristic manner on the pile of a woolen rug.

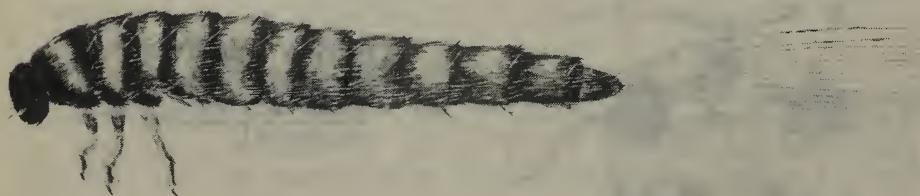


Figure 7 - Larva of the black carpet beetle, Attagenus piceus (much enlarged).

DEVELOPMENT OF FABRIC PESTS

The eggs of clothes moths and carpet beetles are tiny, soft, white objects usually hidden in the pile of fabrics, yet large enough to be seen without a lens if searched for carefully. They hatch in from 6 to 10 days in summer, but may require 30 days for development during colder weather. Clothes moths pass through the egg, larval and pupal stages in from about 60 days to 3 years, according to temperature and food conditions. There is great variation under ordinary warehouse conditions in the time required for the development of one generation. Moths hatching from eggs laid on the same day and apparently fed on the same food, and subjected to the same conditions, will mature at widely separated intervals. Carpet beetle larvae usually require about 1 year for development although their development may extend for 2 or 3 years. They are less prolific, and therefore less troublesome than clothes moths. Because the generations of fabric pests greatly overlap, thus making egg laying possible at most times of the year when the temperatures are above 60°F., the details of biology are less important in general storages where provision against injury must be considered.

CONDITIONS FAVORABLE TO ATTACK BY FABRIC PESTS

The adding of infested stocks to clean storage or the bringing of clean stocks into storage already infested gives fabric pests favorable opportunity for spread to materials that would otherwise remain uninfested. Bringing household effects into storage is a very common method of establishing all fabric pests in storage warehouses. Larvae crawl from infested stocks to nearby consignments, and the adults of all species being able to fly soon spread by flight. Heavy infestations in warehouses usually result from failure to do a thorough job of extermination, which permits the infestation to continue.

PREVENTING INJURY TO FABRIC AND FUR SUPPLIES

Prevention of injury is the ideal procedure in combating fabric pests. Since these insects are cosmopolitan, as a group, and since injury must be expected unless some precautionary measures are taken, any handling or treatment of susceptible supplies to render them distasteful to fabric pests is of value. Two available methods today are mothproofing and the use of flake naphthalene or paradichlorobenzene.

Mothproofing

During the past 20 years much progress has been made in rendering fabrics and furs resistant to insect pests by treating them with so-called mothproofing solutions. From the standpoint of military operations, mothproofing treatments should be applied to suitings and fabrics in the manufacturing process, preferably in the hot dye bath. If clothing or fabrics are treated by methods now available and already in use, they should remain exceedingly resistant to the attack of fabric pests up to the time they are issued and thereafter at least until washed or dry-cleaned about six times. Such mothproofing treatments will eliminate much of the fabric pest injury now known to take place unless goods are kept effectively protected with flake naphthalene or paradichlorobenzene. The present cost of inspection and retreating fabrics in storage with naphthalene is considerable.

Additional information regarding moth-proofing materials may be obtained from the Bureau of Entomology and Plant Quarantine.

Naphthalene and Paradichlorobenzene Crystals

These crystals are in common use today wherever fabrics and furs are stored. Naphthalene is used more generally because it is much cheaper under ordinary circumstances and for long storage periods is quite as effective as paradichlorobenzene. Both chemicals are slow

fumigants, producing by the evaporation of the crystals a vapor heavier than air which penetrates the commodity enclosed with them. The degree of effectiveness in killing fabric pests is in proportion to the tightness of the container in which they are used since the vapors being heavier than air tend to escape from poorly cartoned or packaged goods. They are most effective when used in tightly constructed rooms or warehouse bays, but are still real protectors in tight wooden crates lined well with heavy, unbroken paper. Eggs and very young larvae, such as may escape inspection when goods are packed, are readily killed by these chemicals. Crystals of flake naphthalene or paradichlorobenzene should be used liberally--from 2 to 4 pounds per each 100 cubic feet of tightly enclosed space.

CONTROL MEASURES

When supplies of any sort are found infested, drastic action should be taken as soon as possible. The action taken will depend upon circumstances.

Cold Weather

Fabric pests are incapable of causing harm at temperatures lower than 50°F. Cold storage is usually too expensive for the usual run of military supplies, but when the lower temperatures are available as in the northern climates they can be utilized for protection during limited periods of the year. Moth larvae are killed within 1 to 2 days by zero temperatures, and articles exposed to zero weather will be freed of moth life. Moth larvae have lived 67 days at 20°F. to 25°F., and 283 days at 30°F. to 35°F. In many parts of the country cold weather has little lethal effect upon fabric pests in buildings.

Cold Storage

With the increase in the use of furs and more valuable woolens, particularly in connection with aviation, the demand has increased for a thoroughly safe method of storage, methods having an advantage over the more generalized methods involving the long established

use of crystals and occasional resort to fumigation of large warehouse spaces. The increased value of aviation supplies susceptible to fabric pest attack warrants a higher grade of protection, such as cold storage and fumigable storage.

Protection against fabric pests of all kinds is assured by cold storage. Once in a properly conducted cold storage held at temperatures lower than 50° F., no injury from insects can take place. If it is desired to destroy clothes moths present in articles when they are placed in storage, as well as to protect the articles from injury during the period of storage, it is recommended that the articles be exposed to two or three changes of temperature. It has been found that it is not so much the cold that kills as the sudden change from a cold to a warmer temperature and back to a cold temperature that most quickly results fatally. If articles infested with clothes moths are refrigerated at 18° F., and finally held permanently at about 40° F., all moth life in them would be killed.

If protection during storage period is all that is required, it is sufficient to maintain articles at a temperature of 40° to 45° F. Clothes moth larvae can withstand storage at temperatures ranging from 24° F. to 45° F., for longer periods than that for which most supplies are refrigerated. Well grown larvae of the webbing clothes moth in fur and wool held in commercial cold storage at a temperature said to fluctuate between 24° F. and 48° F., but held mostly at about 40° F., were found to be alive after storage for 6, 8, 10 and 12 months in aviators' fur helmets. Refrigeration for 6 months had no noticeable effect upon the larvae except to hold them inactive and incapable of causing injury. These facts are mentioned to explain why sometimes when furs and other garments are removed from cold storage they are found to harbor living moth worms.

Fumigable Storage for Furs and Woolen Garments

Fumigable storage has the advantage over cold storage in that it does away with the expensive cold storage machinery and costs of operation. It is widely

used today for storage of fur garments by large department stores and storage warehouses. It is giving satisfaction to an ever increasing list of patrons. It depends for its successful operation on the intelligent use of a fumigant in an especially tight enclosure known as a storage vault. These vaults can be of any size needed. The vaults in use throughout the United States have been installed, for the most part, by the Haskelite Manufacturing Corporation, Chicago, Illinois, except where local facilities have been improvised. Various fumigants are being used today in such vaults. The most popular fumigant for this purpose appears to be the ethylene dichloride-carbon tetrachloride fumigating mixture.

Fumigation

When warehoused in modern storages, supplies can be fumigated with hydrocyanic acid gas by an experienced fumigator as they stand in the warehouse. Frequently such fumigation does away with the necessity to repack a commodity. The effectiveness of fumigation will depend upon the method of crating or otherwise packaging the supplies. Most crated supplies can be fumigated with good results. In loosely constructed warehouses fumigations should be conducted in especially constructed rooms or steel fumigation chambers where a heavier-than-air fumigant can be used. An excellent fumigant for this purpose is the ethylene dichloride-carbon tetrachloride mixture used at the standard dosage of 5 quarts, or 14 pounds, for each 1,000 cubic feet of space fumigated. The vapors of this fumigant are free from the fire and explosion hazard and are not harmful to materials. There are also other fumigants that are available for use in vaults.

Caution: Hydrocyanic acid gas is a deadly poison and
should be used only by experienced operators
exercising all safety requirements enumerated
in Circular 22.

Naphthalene and Paradichlorobenzene

Flake naphthalene and paradichlorobenzene, although already mentioned as excellent preventives, are very good killers of all stages of fabric pests, particularly clothes

moths. Unfortunately, to be effective they must evaporate, and once the vapors produced by evaporation are dissipated from one cause or another, the commodity becomes susceptible to infestation. In storages where dependence is placed on these crystals, care should be taken to open containers and repack with fresh supplies of crystals at the rate of 2 to 4 pounds per each 100 cubic feet of space. If articles are removed for inspection before repacking with fresh supplies of crystals, they could well be brushed over shallow trays of kerosene which will catch and kill dislodged moth worms. If the paper lining of the crates or boxes has become torn, fresh supplies of paper should be added. Susceptible supplies stored in open crates may require larger amounts of the crystals without assurance of complete protection. For susceptible supplies stored in large warehouses it would be better to arrange for perfect protection by constructing tight storage rooms of a size to meet the need and keep these, rather than the individual containers, heavily impregnated with crystals. Goods stored in such rooms so heavily stocked with crystals that the eyes and nose will smart when one enters the room will be protected perfectly and any infestation present will be rendered inactive and ultimately killed. The strong odor in tight storage rooms may be disagreeable, but it is not dangerous and presents no fire hazard.

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